UNITED STATES DEPARTMENT OF THE INTERIOR

Fisheries Assistance Office

U. S. Fish and Wildlife Service

Olympia, Washington

HABITAT QUALITY AND FISH USAGE OF FIVE CHEHALIS RIVER TRIBUTARIES IN THE SOUTH ABERDEEN - COSMOPOLIS AREA

October 1984

Prepared for

Seattle District

U.S. Army Corps of Engineers

by

Mike Paiya
Fishery Management Biologist

John H. Meyer
Assistant Project Leader

Ralph S. Boomer
Project Leader

TABLE OF CONTENTS

INTRODUCTION

The Seattle District of the U.S. Army Corps of Engineers is conducting planning and engineering studies for a proposed 4.7 mile levee and flood wall along the south side of the Chehalis River to provide flood protection to south Aberdeen and Cosmopolis (Figure 1). This study was conducted by the U.S. Fish and Wildlife Service to provide information needed to help identify potential environmental impacts of this project. The study area includes a segment of the Chehalis River and five small tributaries, Alder and Mill creeks, and Miller, Shannon and Devonshire sloughs.

At least one of these streams is known to support anadromous fish and another has the potential to provide spawning habitat. Although the estuarine sloughs do not support spawning habitat for anadromous fish, they do provide potential rearing areas during the spring and summer out migration periods. Simenstad (1983) has documented the important functions of estuarine channels in the Pacific Northwest. He describes their contribution to primary productivity, detritus processing, invertebrate productivity, rearing areas for fishes including salmonids, and as a transition zone between fresh and marine waters.

The objectives of this investigation are to describe and evaluate the aquatic habitat in the study area, gather some additional information on existing fish usage, and map the aquatic habitat within the study area.

METHODS

Aquatic habitat quality data was gathered from field observations made during August and September, 1984. Observations were made on the mainstem Chehalis River, Mill and Alder creeks, and Miller, Shannon and Devonshire sloughs. Each water course was initially surveyed along as much of its banks as access would allow and then divided into segments which exhibited similar habitat types (eg. intertidal, steep cascade, forested, etc.). In each segment, a point was randomly selected and the habitat was described over a distance of approximately 14 times the average wetted stream width (Bovee, 1982).

The following parameters were noted at each stream site:

1. Average wetted width
2. Total width of stream bed
3. Pool/riffle ratio
4. Deepest point in pool
5. Vegetation on each bank
6. Stability of each bank
7. % overhanging vegetation
8. Instream cover (%, quality type)
9. Bottom composition
10. Water temperature
11. Dissolved oxygen

These parameters were selected because they have been recognized as important in determining habitat quality for stream rearing salmonids (Raleigh et al, 1984 and McMahon, 1983).

Habitat parameters collected in sloughs included:

1. Average width at low tide
2. Deepest point at low tide
3. Instream cover
4. Bottom composition
5. Water temperature
6. Dissolved oxygen

Fish usage of Alder and Mill creeks during the study period was determined by a limited amount of sampling using an electro-shocker. This sampling provided instantaneous information on species of fish utilizing the streams. The sampling was not intended to gather quantitative data. The timing of the study did not allow sampling during the predicted periods of peak salmonid use. A section of stream approximately 50 yards in length was shocked in the upper section of each stream. All salmonids were enumerated and their fork length measured in millimeters.

Some sampling in the sloughs was attempted with electro-shockers but conductivity of the water was too high for effective sampling. The water quality measurements in these sloughs made it unlikely that salmonids were present at the time our sampling occurred. Simenstad and Eggers (1981) found the abundance of juvenile salmonids in the shoreline areas of Grays

Harbor to be greater during spring than late summer. Sampling the sloughs in the project area during spring would be required to determine actual salmonid usage.

HABITAT MEASUREMENTS AND FISH USAGE

Grays Harbor is described by the Washington State Department of Fisheries (WDF) as an important area providing an essential fresh-salt water conversion zone and feeding ground for juvenile salmonids produced in the Chehalis River basin (Phinney and Bucknell, 1975). Chinook, coho and chum salmon are common. Anadromous steelhead and cutthroat trout are also common. The timing of these runs are as follows:

Chinook - Spring and fall returns are present. Spring runs enter the estuary from March through June. Fall chinook return from August through November. Simenstad and Eggers (1981) found chinook juveniles in the estuarine area from early April through October. They were found both in shallow and deep areas and were apparently rearing for an extended period.

Coho - Coho return to Grays Harbor from September through February. The run consists of separate early and late spawners. The early segment spawns before January first and the late segment after. Simenstad and Eggers (1981) found coho juveniles in the estuary from mid-April through mid-June. His results suggested that after rearing one year in freshwater, coho juveniles immigrated rapidly through the estuary.

Chum - Returning chum salmon enter Grays Harbor in early October through mid-December. Spawning peaks in mid-November. Simenstad and Eggers (1981) concluded that juvenile chum were present in the estuary during January and had departed by early May. The juveniles used the shallow areas almost exclusively.

Steelhead - Steelhead trout enter freshwater throughout the winter and summer months. The summer run fish generally spawn during early winter. Winter run fish spawn from January through May. Juveniles rear in freshwater for one to two years. Simenstad and Eggers (1981) found juvenile steelhead in the estuary from mid-May through the end of July.

Cutthroat - Cutthroat trout generally enter freshwater during early fall and spawn in the spring. The juveniles apparently migrate during the same period as steelhead.

Mainstem Chehalis River

The habitat data for the mainstem Chehalis River site was collected on September 7, 1984. No physical measurements were taken and no fish sampling was conducted since the fish utilization of the Chehalis River is well documented in the literature. Simenstad and Eggers (1981) found juvenile salmonids using the Chehalis River in the project area throughout the spring and summer months. Phinney and Bucknell (1975) state that both juvenile and adult salmonids use the area. The proposed levee alignment is adjacent to the Chehalis River in two locations. They are essentially similar in habitat characteristics. Area 1 (refer to accompanying habitat

map) begins about 1.9 miles upstream (east) from the Aberdeen-South Aberdeen bridge and extends .75 miles farther upstream. Area 2 begins about 800 feet upstream of the bridge and extends 0.5 miles downstream from the bridge. The entire area is tidally influenced. Eelgrass, marsh grass and pickleweed are growing intermittently on the mud bottom. Wood debris is scattered across the shallows and river bank. The river bank is well vegetated with grasses and deciduous trees and brush.

Alder Creek

Alder Creek is a small stream which enters the Chehalis 200 feet east of the Aberdeen-South Aberdeen bridge. The creek originates about 5 miles south in some low hills. An impoundment called Lake Swano blocks all upstream migration about 3.75 miles from the mouth. There is also a top hinged tide gate at the creek's mouth which impedes migration.

Alder Creek separates into three habitat types. The first is intertidal reach that winds through a residential section of South Aberdeen. The second section is a free flowing reach of very low gradient. This section is essentially undeveloped with overhanging brush and trees. The third reach is on Grays Harbor College property and has had river gravel spread along its length to improve habitat quality. The entire creek was apparently channelized 40 - 50 years ago. The habitat quality data for Alder Creek was collected on August 14, 1984.

The intertidal reach is a series of city block long pools with culverts connecting them. The pools average about 35 feet in width (Table 1). The depth of the pools was difficult to determine because the bottom was deep mud. The water temperature on the survey date was 63°F and the dissolved oxygen measured 4.9 parts per million (ppm). The amount of instream cover was fair with debris from adjacent residences and deciduous vegetation growing in or laying on the water providing most of the cover. Ten to 20% of the water surface had bank vegetation overhanging. The creek banks are fairly stable since they are either fully vegetated or stabilized with riprap.

The free flowing middle reach of Alder Creek meanders through deciduous lowland forest. There is little human activity along this stretch. The stream averaged about 6 feet in wetted width and 10 feet total width. The maximum depth was 12 inches. The pool/riffle ratio was about 70% pool/30% riffle. In most areas the banks were heavily vegetated with trees and shrubs growing directly adjacent to the stream with the roots helping to stabilize the bank. In some areas only wild grasses are present and erosion does occur. The riparian canopy shades 90% of the water's surface. The instream cover in this reach consists mainly of wood debris, logs, and roots of live trees. The bottom is composed of fine silt or mud. The water temperature measured 62°F and the dissolved oxygen measured 7.9 ppm.

Habitat values in the upper reach of Alder Creek are similar to the previously described free flowing section except the instream debris has been removed and 1,000 lineal feet of spawning gravel has been installed to a depth of 18 inches. Debris clean-up, bank stabilization, and vegetation removal and replanting are also planned. The Grays Harbor College fisheries program is promoting this enhancement project and plans to rehabilitate the entire creek eventually.

Table 1. Habitat parameters for Alder and Mill creeks.

Habitat Variable	Alder Creek			Mill Creek		
	Intertidal	Middle	Upper	Intertidal	Middle	Upper
Average Wetted Width (feet)	35	6	7	12	8	12
Average Streambed Width	35	10	10	55	13	18
Pool/Riffle Ratio	1/0	7/3	1/1	1/0	2/1	1/1
Deepest Point (inches)	39	12	11	14	20	20
Streambank Stability	Moderate	Moderate	Moderate	Moderate	High	Low
Plant Types	Willow, Concrete, Grass	Trees, Shrubs	Deciduous Trees, Brush	Grasses, Brush	Concrete, Brush	Deciduous Trees, Bush
% Overhanging Vegetation	20	90	95	10	50	95
Instream Cover	Fair	High	Moderate	Fair	Fair	High
Bottom Composition	Fines	Primarily Fines	Gravel	Fines	Fines, Small Gravel	Small Gravel
Water Temperature (F)	63	62	63	60	60	59
Dissolved Oxygen (ppm)	4.9	7.9	7.9	9.2	8.8	9.0

Fish Usage in Alder Creek

A survey to determine fish presence in Alder Creek was completed August 15, 1984. A section of stream approximately 50 yards in length was sampled using a backpack electro-shocker. The area sampled was adjacent to the Grays Harbor College soccer field. Fifteen coho salmon and 2 trout were caught. Pacific lamprey juveniles, sticklebacks, and sculpins plus crayfish were also captured. The trout were 63 and 65 mm in length. The coho salmon averaged 79 mm in length. The length of both the trout and salmon indicated that they were progeny of the 1983-1984 spawning season.

Grays Harbor College has a hatchery on Alder Creek above the sampling site from which they released 298,000 coho fry into the stream in 1983. In 1984, the College is incubating 100,000 coho and 125,000 steelhead eggs. Adult coho have returned to the facility since 1979. The flood gate at the Chehalis River is blocked open at the appropriate time to allow adult anadromous fish to pass. The coho and trout captured in our sampling may have escaped from the College's enhancement project or they may be the progeny of the wild spawners.

Mill Creek

Mill Creek is similar to Alder Creek in size. It enters the Chehalis River approximately 2.4 miles east of the Aberdeen-South Aberdeen bridge. The lower half of the creek is tidally influenced. There has been relatively little development in this section. The next reach winds through a residential area and the third section lies within a park which is maintained by the City of Cosmopolis. These three sections are logically separated and will be described separately. The habitat quality data concerning Mill Creek was collected August 13, 1984.

Lower Mill Creek is intertidal and along much of its length relatively inaccessible because of heavy brush growth.

The study section for this reach extends upstream from the railroad bridge behind the Cosmopolis Lyons Club Park. The average low tide width of the wetted area was 12 feet. The average width of the total stream bed at high tide was about 55 feet. The bottom is composed of mud and a few logs or limbs which provided minor areas of instream cover at low tide. Near the high tide mark, various marsh grasses grow. Above the tide mark a heavy deciduous growth of brush begins. At high tide, the growth on the bank overhangs about 10% of the wetted area. At low tide no overhang occurs. The maximum depth was about 1.5 feet at low tide. The water temperature was 60°F and the dissolved oxygen level was 9.2 ppm.

The middle reach of Mill Creek flows through a residential section. It was channelized 40 or 50 years ago along with the rest of the creek. The creek banks are generally lined with concrete riprap which has ivy or some other terrestrial ground cover growing above the water mark. The average total width of the stream during normal winter flows is 13 feet. The average wetted width observed on August 13 was 8 feet and the deepest area observed was 20 inches. The pool/riffle ratio was about 2/1. Since the stream ran through a residential area, large trees and ornamental shrubs were growing close in most areas. This created about 50% overhang. The most common

instream cover was created by concrete pieces which had come from the riprap banks. There was also occasionally some discarded branches in the stream from an adjacent residence.

The water temperature was 60°F and the dissolved oxygen level was 8.8 ppm. The bottom was composed of small gravel and fine sand.

The upper reach of Mill Creek is located in a well-maintained park. At the upper end of the park section a dam forms Mill Creek Pond and creates an impassable barrier to fish migration. The stream banks are maintained with concrete walls in places but generally are unprotected and open to erosion. The low canopy of deciduous brush covers about 25% of the stream surface. The high alder canopy covers about 95%. The bottom composition is similar to the residential reach. The instream cover is typically logs, roots of live trees, cut banks and wood debris. The pools in the study section were about 20 inches deep. The water temperature was 59°F and the dissolved oxygen measured 9.0 ppm.

Fish Usage of Mill Creek

We electro-fished a 50 yard section of Mill Creek in the park on August 15, 1984. Nineteen coho salmon, one cutthroat trout, and four juvenile trout were caught. Sculpins, peamouth chub, juvenile Pacific lamprey and crayfish were also collected. The coho salmon averaged 80.5 mm in length, indicating that they were 1983 brood juveniles. The four juvenile trout averaged 80.5 mm indicating that they were also 1983-1984 brood juveniles. The cutthroat trout was 170 mm.

WDF and Washington Department of Game were contacted to determine if fish had recently been planted in Mill Creek. They indicated that there had not been any recent plants. The presence of juvenile anadromous fish probably indicates adults had spawned there; however, the juveniles may have migrated into the area from the Chehalis River.

Mill Creek Slough

Mill Creek Slough enters Mill Creek on the west bank about 800 feet upstream from the mouth. The slough drains a low wooded area between South Aberdeen and Cosmopolis. It is also tidally influenced. The habitat quality data for Mill Creek slough was collected August 14, 1984.

A railroad grade forms the right bank of the slough from its mouth upstream about 1,600 feet. At low tide the average wetted width of the slough was 9 feet (Table 2). The average wetted width at the high tide mark was 28 feet. The discharge was approximately two cubic feet per second when measured just prior to low tide. A salinity measurement would be needed to determine if the discharge was tidal or freshwater. The bottom of the slough consisted of mud with a few rocks that sloughed off of the railroad grade. There are a few logs lying in the slough and also a small amount of vegetation which provides some instream cover.

Table 2. Habitat values for Mill Creek, Devonshire, Miller, and Shannon sloughs.

Habitat Variable	Miller Creek Slough	Devonshire Slough	Miller Slough	Shannon Slough
Average width at low tide (feet)	9	8	3	3
Deepest point at low tide (inches)	16	20	6	6
Instream cover	Poor	Fair	Poor	Fair
Bottom composition	Mud/rock	Mud	Mud	Mud
Water temperature (F)	61	59	62	60
Dissolved oxygen (ppm)	7.1	3.6	*	5.8

* The dissolved oxygen meter's needle went off the upper end of the scale in this slough. Something apparently was interfering with the meter since a few minutes later an appropriate reading was obtained at the upper Mill Creek site.

Fish Usage of Mill Creek Slough

We were unable to effectively sample the fish population because the water was too conductive for electro-fishing. Sticklebacks and sculpins were observed during the habitat quality data collection.

Devonshire Slough

Devonshire Slough enters Grays Harbor approximately 1 1/4 miles west of the Aberdeen-South Aberdeen Bridge. The habitat quality survey was done on August 15, 1984 at low tide.

The proposed levee alignment crosses the slough about 1,200 feet upstream from the mouth. The mouth of the slough flows across an extensive mudflat. The slough has a mud bottom which is sparsely littered with wood debris.

There is little instream cover at low tide. The slope of the banks are mud with pickleweed and marsh grass growing just below the high tide mark. Willows, alders and various deciduous shrubs are growing at the top of the banks. The width of this slough became quite narrow just above the proposed levee crossing. Aquatic and terrestial vegetation in the stream became quite heavy at this point greatly reducing water movement. the water temperature on August 15 was 59°F and the dissolved oxygen was quite low at 3.6 ppm. There was not enough flow out of the slough to be measured.

Since the D.O. was low, we assumed there would be no fish usage and did not attempt to sample this slough. The low D.O. may have been the result of the city of Aberdeen's ditch cleaning work upstream from Filmore Road.

Miller Slough

Habitat quality information for Miller Slough was collected August 15, 1984.

The mouth of Miller Slough is located about 1 1/2 miles east (upstream) of the Aberdeen-South Aberdeen bridge. The slough originates in a bushy area about 1/2 mile southwest of its mouth. It winds through a residential area for approximately 1,200 feet, then is channeled through the Weyerheauser Company's "Bay City" log sorting yard before emptying into the Chehalis River. There is a top hinged tide gate just upstream from the river. The gate closes when water attempts to come in from the river and should allow little, if any, access by fish from the Chehalis River. The proposed levee alignment is along the upstream boundary of the log sorting yard.

In the residential area, upstream from the proposed levee alignment, water exchange is very slow through the culverts which are under the roads. The water in these backed-up areas appears stagnate. The temperature on August 15 was 62°F. The dissolved oxygen meter's needle went off the upper end of the scale in this slough. Something apparently was interfering with the meter since a few minutes later an appropriate reading was obtained at the upper Mill Creek site. The meter manufacturer was contacted for a possible explanation. They indicated that radio signals or stray electrical

currents could possibly interfere with the meter's functions. Despite this problem, we suspect that the dissolved oxygen level in this stream was quite low.

Downstream of the levee alignment, this slough is basically a ditch about 20 feet wide with a mud bottom and grass covered banks. There was oil on the bank in several areas and in the water. There was not enough out flow to measure. The maximum water depth was less than 3 feet.

The general low quality of the habitat and presence of the tide gate led to the assumption that no fish would likely be captured by any methods at our disposal, so no sampling was attempted.

Shannon Slough

Shannon Slough was inspected on August 15, 1984. This slough enters the Chehalis River about 1/2 mile east of the Aberdeen-South Aberdeen bridge. The slough's mouth is in Weyerheauser's "Aberdeen" sort yard. From there, the slough runs southwest about 1,200 feet. There is a top hinged tide gate at the mouth of the slough. The gate is currently a barrier to fish access from the Chehalis River. There was little variation in habitat along the length of the slough. The bottom of the slough is mud and is littered with logs, old pilings and debris. The bank slopes are also mud with deciduous trees and shrubs growing along the upper bank and overhanging the slough. The wetted area was about 3 feet in width. Water quality in this slough appeared to be poor. The water temperature was 60°F and the dissolved oxygen measured 5.8 ppm. There was not enough flow to measure. Three-spine sticklebacks were observed in the slough.

DISCUSSION

The undeveloped intertidal areas along the mainstem Chehalis River are used by juvenile salmonids as out migration pathways and rearing areas. We suspect that the timing, species composition and abundance data collected by Simenstad and Eggers (1981) at Sand Island and Cosmopolis apply to these two areas. Based upon their work, juvenile chums should be encountered at these sites beginning as early as January. This species would reach greatest abundance during March and April. Juvenile chinook and coho would be utilizing the area beginning in mid-April. Coho would have left the area by late June while chinook would peak in abundance at this time. Some chinook would continue to use the site into late summer although their distribution will probably begin shifting to deeper offshore areas after June. Smaller numbers of juvenile steelhead and cutthroat could also be expected to utilize these sites during spring and summer.

Alder Creek contains some salmonid spawning areas in its upper reaches. Much of this habitat has been enhanced by the efforts of Grays Harbor College. Apart from the area already improved by the College, the salmonid habitat in Alder Creek is limited and of fair quality, but capable of supporting anadromous fish. The pool/riffle ratio and instream cover in the two upper sections is good. Bank stability is moderate throughout all three sections. The bottom composition contains a high percentage of fines which limits spawning area and productivity of aquatic insects. Water quality in the lower section is questionable but may be more suitable during the spring and early summer when the heaviest use of these areas would be expected.

In addition to habitat improvements, Grays Harbor College has increased the capacity of their aquaculture facility (Grays Harbor Regional Planning Commission, 1984). A building to house parts of the enhancement operation is being constructed as well as a 20' x 20' rearing pen. These improvements will increase returns of coho and steelhead to Alder Creek.

Mill Creek also contains moderate amounts of salmonid spawning and rearing habitat. Although the streambank stability in the upper section of this stream was low, all other parameters were favorable for salmonid spawning and rearing. The middle and lower sections of this stream are probably used primarily as rearing areas although the middle section is capable of supporting some spawning. Water quality on the sampling date was good in all sections.

While there are no existing enhancement facilities on Mill Creek, it has in the past been planted with coho and steelhead when surpluses have been available at state hatcheries. The juveniles captured by electro-shocking were probably the offspring of fish which spawned naturally in the stream.

Mill Creek Slough was the only slough area which appeared to be capable of supporting any significant numbers of salmonids. This conclusion was based upon the availability of better water quality and greater area. Slough habitat similar to Mill Creek Slough is utilized by juvenile chinook, chum, and coho in various locations in Puget Sound and British Columbia (Congelton, 1978; Meyer et al, 1981; and Levy and Northcote, 1981). We

suspect use of Mill Creek slough as a rearing area by juvenile salmonids migrating out of Mill Creek and other areas of the Chehalis River system. The timing and species composition of the fish utilizing the slough is probably very similar to that discussed for the mainstem Chehalis site.

The other three sloughs assessed in this evaluation, Devonshire, Miller, and Shannon, do not appear to be capable of supporting juvenile salmonids above the proposed levee alignment. Each of these sloughs was fairly small in area with steep banks and numerous debris blockages. Water quality was very poor in each. Dissolved oxygen levels were at our below tolerable levels and there appeared to be very little water exchange.

Our conclusions are based upon observations made in late summer and fall when little use of these sloughs would be expected. Simenstad and Eggers (1981) demonstrated substantial use of shallow areas in Grays Harbor during spring and early summer when water quality could be much better. However, with the very limited amount of available habitat and degraded condition of these three sloughs, we seriously doubt there would be any use above the proposed levee alignment.

REFERENCES

Bovee, K.D. 1982. A guide to stream habitat analysis using the instream flow incremental methodology. Instream flow information paper No. 12. USDI Fish and Wildlife Service, Office of Biological Services. FWS/OBS-82/26. 248 pp.

Congelton, J.L. 1978. Feeding patterns of juvenile chum salmon in the Skagit River salt marsh. In Fish Food Habits Studies, Proceedings of the Second Pacific Northwest Technical Workshop. Ed. S. Lipovosky and C. Simenstad. 1978. p 141-150.

Grays Harbor Regional Planning Commission. 1984. An action plan for Grays Harbor fishery enhancement. Status report No. 2. 36 pp.

Levy, D.A. and T.G. Northcote. 1981. The distribution and abundance of juvenile salmon in marsh habitats of the Fraser River estuary. Westwater Res. Ctr., Un. of British Columbia, Tech. Rpt. No. 25, 117 pp.

Meyer, J.H., T.A. Pearce, and S.B. Patlan. 1981. Distribution and food habits of juvenile salmonids in the Duwamish estuary Washington, 1980. U.S. Fish and Wildlife Service, 42 pp.

McMahon, T.E. 1983. Habitat suitability index models: Coho salmon. USDI., Fish Wildl. Serv. FWS/OBS-82/10.49. 29 pp.

Phinney, L.A., and P. Bucknell. 1975. A catalog of Washington streams and salmon utilization. Volume 2 Coastal Region. Washington Dept. of Fisheries.

Raleigh, R.F., T. Hickman, R.D. Solomon, and P.C. Nelson. 1984. Habitat suitability information: Rainbow trout. U.S. Fish. Wildl. Serv. FWS/OBS-82/10.60. 64 pp.

Simenstad, C.A. 1983. The ecology of estuarine channels of the Pacific Northwest coast: a community profile. U.S. Fish Wildl. Serv. FWS/OBS-83/05. 181 pp.

Simenstad, C.A. and D.M. Eggers. 1981. Juvenile salmonid and baitfish distribution, abundance, and prey resources in selected areas of Grays Harbor, Washington. Final Rpt. to Seattle District, Corp. of Engineers. FRI-UW-8116. 205 pp.